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**ТИББИЁТДА ЯНГИ КУН**

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## SANITARY-HYGIENIC AND ENVIRONMENTAL ASPECTS OF USING CERTAIN PESTICIDES IN HOT CLIMATE

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✓ ***Resume***

***This article presents data on the acute and chronic toxicity of the pesticide Zencor.***

***Under natural experimental conditions, the migration, translocation, and persistence (resistance) of widely used pesticides in agriculture—**Zencor** and **Kotofor**—were studied. When examining the processes of migration, accumulation, and translocation of Zencor and Kotofor in the soil-plant system, factors that may influence these processes under the soil and climatic conditions of Uzbekistan were taken into account.***

***Keywords: Zencor, Kotofor, toxicity, soil, plants, migration, translocation.***

## ISSIQ IQLIMDA AYRIM PESTITSIDLARDAN FOYDALANISHNING SANITARIY-GIGIENIK VA ATROF-MUHIT JIHATLARI

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✓ ***Rezyume***

***Ushbu maqolada Zencor pestitsidining o'tkir va surunkali toksikligi haqida ma'lumotlar keltirilgan.Tabiiy tajriba sharoitida qishloq xo'jaligida keng qo'llaniladigan pestitsidlar - **Zencor** va **Kotofor** - migratsiyasi, translokatsiyasi va turg'unligi (qarshiligi) o'rganildi. Zencor va Kotoforning tuproq-o'simlik tizimidagi migratsiyasi, to'planishi va translokatsiyasi jarayonlarini o'rganishda O'zbekiston tuproq va iqlim sharoitida bu jarayonlarga ta'sir qilishi mumkin bo'lgan omillar hisobga olindi.***

***Kalit so'zlar: Zencor, Kotofor, toksiklik, tuproq, o'simliklar, migratsiya, translokatsiya.***

## САМОГИГИЕНИЧНЫЕ И ЭКОЛОГИЧЕСКИЕ АСПЕКТЫ ИСПОЛЬЗОВАНИЯ ОПРЕДЕЛЕННЫХ ПЕСТИЦИДОВ В ЖАРКОМ КЛИМАТЕ

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✓ ***Резюме***

***В данной статье представлены данные об острой и хронической токсичности пестицида «Зенкор».***

***В естественных экспериментальных условиях изучались миграция, транслокация и персистенция (резистентность) широко используемых в сельском хозяйстве пестицидов — «Зенкор» и «Котофор». При изучении процессов миграции, накопления и транслокации «Зенкора» и «Котофора» в системе почва-растение учитывались факторы, которые могут влиять на эти процессы в почвенно-климатических условиях Узбекистана.***

***Ключевые слова: «Зенкор», «Котофор», токсичность, почва, растения, миграция, транслокация.***

## Relevance

Pesticides occupy a special place among chemical pollutants of the environment that can significantly impact public health. It is well known that without the use of modern agricultural chemicals, achieving high and stable yields of a wide variety of crops is impossible. At the same time, the increasing use of chemical crop protection products poses a risk of environmental pollution with toxic substances and adverse effects on humans [1, 2].

The intentional introduction of pesticides promotes their circulation in the environment (plants, soil, water, air, food), which exposes large numbers of people to pesticide residues. Pesticide active ingredients can travel significant distances in air and water, and food products containing their residues are distributed not only within a single country but also between countries. Consequently, these xenobiotics can enter the human body through various routes: direct contact during production and use, through food products, and through contaminated water and air, etc. [2-4]

The increasing use of chemicals in agriculture, while contributing to higher yields and significant economic benefits, also introduces new biologically active factors into the environment. [9-12] This complicates the problem of protecting the environment from potential adverse effects. The hygienic justification of permissible residue levels of pesticides in food products and other environments, as well as the regulation of their usage, taking into account the diverse factors influencing the longevity of these chemicals in nature, forms the basis of a system for preventing their negative impact on humans. [8-10]

According to sanitary legislation, no chemical substance may be allowed for use in the national economy without a thorough toxicological and hygienic evaluation.

**Objective of the Study:** тo assess the risk posed by Zencor and Kotofor to humans and develop regulations that ensure consumer safety and maintain the nutritional value of food products under the conditions of hot climates, particularly in Central Asia.

## Objects and Methods of the Study:

The objects of the study were the pesticides Zencor (70% wettable powder, produced by Bayer, Germany) and Kotofor (80% wettable powder, produced by Ciba-Geigy, Switzerland). The toxic properties of Zencor were studied on sexually mature animals of both sexes (white mice and rats). In selecting tests to assess the effects of Zencor on test animals, we used data from the literature on the effects of triazine pesticides on specific organs and systems.

The persistence (resistance) and processes of migration and translocation of the herbicides Zencor and Kotofor in the soil-plant system were studied, along with a hygienic evaluation of the quality of food products (tomatoes, potatoes, watermelons) grown on soil treated with these herbicides. The study was conducted in four farms in Bukhara region, Uzbekistan, on different soil types (serozem and gravelly soils) and under different irrigation conditions (furrow and sprinkler irrigation). The results of hygienic and toxicological studies were statistically processed using a Pentium III computer with Microsoft Office 2010 SR-1. Student's criteria were used to determine the average error and the reliability of the obtained data.

**Discussion of Results:** Currently, new promising herbicides from the triazine group, such as Zencor and Kotofor, are proposed for use in agricultural practice. During testing in the agricultural system, the high production and economic efficiency of these products was established.

Based on this, the goal of our research was to assess the danger of Zencor and Kotofor to humans based on our experimental studies and a review of literature. We aimed to determine whether it is feasible to use these herbicides in agriculture and to develop hygienic regulations that ensure the safe application of these herbicides on food crops in Uzbekistan and regions with similar soil and climate conditions.

Since the toxicological and hygienic assessments of new pesticides, as well as the subsequent regulation of their use, should be based on data regarding the fate of these products in the environment and in food products, we studied the migration, translocation, and persistence of Zencor and Kotofor in soil and plants under natural experimental conditions.

When examining the processes of migration, accumulation, and translocation of Zencor and Kotofor in the soil-plant system, factors that may affect these processes under the soil and climatic conditions of Uzbekistan were taken into account.As a result of the research, it was found that the residual content of Zencor and Kotofor in the soil under different crops was not uniform. For example, under equal conditions (soil type, temperature, moisture, and herbicide application rate), the highest amount of Zencor was found in the soil of tomato fields, followed by potato fields (0.23–0.95 mg/kg and 0.195–0.610 mg/kg, respectively, with **p<0.05**). This is likely related to differences in the microflora of the rhizosphere of these crops and different agronomic practices used on vegetable and potato plots.

There was a noticeable difference in the degree of Zencor translocation in plants depending on the growth periods and the time of herbicide application to the soil. For example, when Zencor was used to treat soil before spring planting of potatoes, its residual content in the leaves and tubers was 30,0–37,5% and 47,6–60,0% higher, respectively, than in summer-planted potatoes. This is likely due to physiological and biochemical processes associated with the potato's sorption capacity during different growing seasons.

It was also observed that the residual levels of Zencor and Kotofor in the soil and their translocation into crops depended on the method of irrigation. For instance, in spring-planted potato fields treated with Zencor, the concentration in the 0–20 cm soil layer was 0.295–0.8 mg/kg under furrow irrigation and 0.34–0.91 mg/kg under sprinkler irrigation (about 15–55% higher). The transfer of Zencor into crops under sprinkler irrigation was 30–50% higher than under furrow irrigation, and even more pronounced differences were observed for Kotofor. The residual levels of Kotofor in the soil under the studied crops were 40–100% higher with sprinkler irrigation compared to furrow irrigation.

The type of soil also affected the migration of Zencor through the soil profile and its translocation into plants. When Zencor was used to treat gravelly soil, its residual content in the 20–30 cm soil layer was 29,2–38,0% higher than in loamy serozem soil. Similarly, Zencor residues in tomatoes grown on gravelly soil were higher than in those grown on serozem soil.

Persistence of Herbicides:

The persistence of Zencor and Kotofor in the environment was studied, and it was determined that these herbicides are relatively stable, remaining in the environment for up to 6–7 months, i.e., more than one growing season. Zencor migrated to a depth of up to 30 cm in the soil, while Kotofor reached up to 20 cm. The highest concentrations of these herbicides were found in the 0–10 cm soil layer.

The maximum content of Zencor and Kotofor in the upper soil horizon is explained, on one hand, by the low volatility of methyl-ethylthio-s-triazines from the soil surface, and on the other hand, by the relatively high organic matter content in the plow layer of the soil. The duration of persistence (**T95**) ranged from 171 to 204 days for Zencor and from 102 to 162 days for Kotofor, depending on the application rate and the type of irrigation.

Moreover, when Zencor and Kotofor were used under sprinkler irrigation, compared to furrow irrigation, there was increased accumulation of the herbicides in the soil and prolonged persistence. This can be explained by the fact that triazines, due to their physical-chemical properties (molecular structure and minimal interaction with fat-like substances in the soil), remain on the surface of soil particles for a long time without being adsorbed. Therefore, during furrow irrigation, they can partially be washed away by irrigation water. Additionally, furrow irrigation results in higher soil moisture than sprinkler irrigation. In moist soil, as has been proven, the activity of soil microorganisms involved in the breakdown of pesticides is enhanced, and biochemical processes in moist soil are more intense, contributing to the inactivation of herbicides in the soil.

The above-mentioned facts indicate the possibility of accumulation of the studied herbicides in food products and their entry into the human body. Data from the literature shows that pesticides, being chemically active substances, can penetrate plants and influence biological processes, such as altering the activity of photosynthesis and respiration, disrupting the interaction of enzymes associated with various metabolic pathways, and more (A.A. Bogdarina, A.M. Ikonnikova, 2004; H. Pekenyo et al., 2005; E.A. Tumanova, 2007).

As a result of the impact of pesticides and their metabolites on metabolic processes, redistribution of nutrients in plant tissues, reduction or stimulation of their accumulation, and the destruction of vital components are possible. Consequently, there is a change in the appearance, taste, and nutritional value of food products (E.A. Antonovich, 2001; V. Preverzenova, 2004).

The herbicides we studied influenced plants and altered their metabolic processes, which was reflected in more or less pronounced changes in the content of certain ingredients in the resulting food products.

It is noteworthy that the nature of the changes in the chemical composition of plant products depended on factors that influenced the behavior of the studied pesticides in the soil and plants. For instance, when Zencor was applied at a rate of 0.5 kg/ha, the vitamin C content in spring-planted potato tubers did not differ significantly from the control. However, as the herbicide application rate increased 2–4 times, the level of ascorbic acid in the potatoes decreased.

The application of Zencor to the soil at a rate of 1,0kg/ha contributed to an increase in the concentration of vitamin P in potato tubers. However, when the application rate was increased to 2,0 kg/ha, the amount of vitamin P in potatoes decreased.

The nature of the changes in the chemical composition of plant products under the influence of herbicides also depended on the soil and climatic conditions. This was confirmed by studies of tomatoes grown in serozem and gravelly soils.

For example, in tomatoes grown in serozem soil at a Zencor application rate of 1,0 kg/ha, no significant changes in the vitamin P content were noted. However, under the conditions of gravelly soil, the herbicide contributed to the accumulation of this component in tomatoes.

When Zencor was applied to serozem soil at a rate of 1,5 kg/ha, an increase in the beta-carotene content in tomatoes was observed. However, in gravelly soil, the opposite occurred, with a reduction in beta-carotene (see Figure 2)

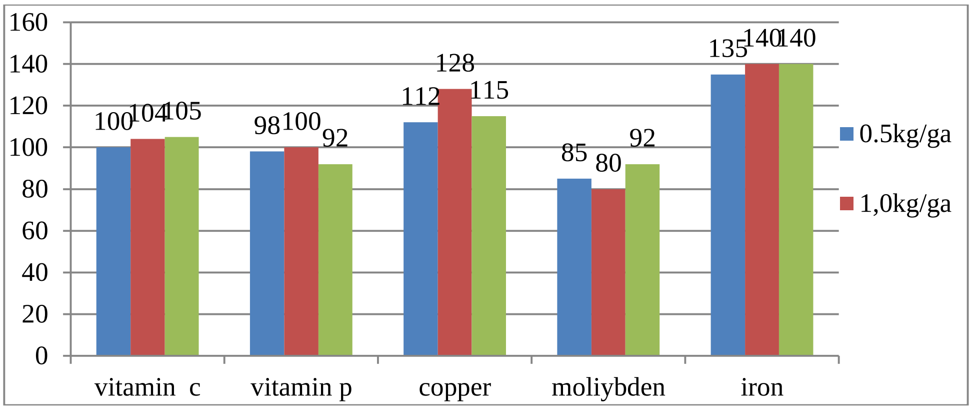


**Fig. Figure 2 Some indicators of the chemical composition of potatoes grown on soil treated with zenkor (spring planting)**

The direction of changes in the chemical composition of plant products under the influence of herbicides also depended on the type of crop. For example, the application of Zencor at a rate of 20 kg/ha on potato plantings did not affect the cobalt content in the tubers. However, in tomatoes, under the same conditions, the cobalt content was significantly reduced.

The direction of changes in the chemical composition of plant products under the influence of Zencor also depended on the season of cultivation. For instance, the application of Zencor to spring potato plantings at a rate of 0.5–20 kg/ha did not result in statistically significant changes in the total protein and starch content in tubers.

The nature of the influence of the studied herbicides on the nutritional value of food products also varied. Zencor, when used on spring-planted potatoes at a rate of 0.5–20 kg/ha, did not significantly affect the content of dry matter, total protein, or starch in the tubers. At the same time, Kotofor, applied at a rate of 20 kg/ha, caused a noticeable increase in starch content in potatoes (see Figure 3).

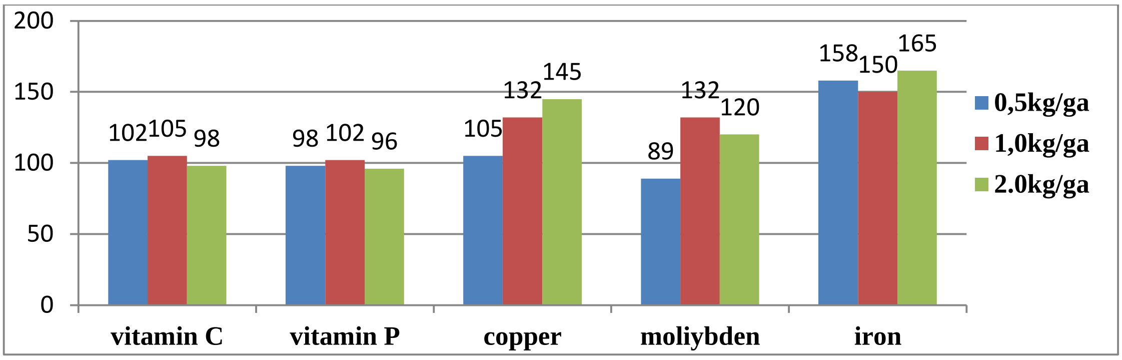


**Figure 3: Some indicators of the chemical composition of potatoes grown in soil treated with Zencor (spring planting Based on the toxicological and hygienic evaluation of Zencor and Kotofor, we consider it feasible to use these herbicides in agricultural production, provided the following conditions, outlined in Table 1, are met:**

| Herbicide | Crop | Recommended application rate (kg/ha) | Waiting period (days) | Application conditions |
|---|---|---|---|---|
| Zencor | Potatoes | 10 | 100–110 | Serozem soil |
| Zencor | Tomatoes | 15 | 85 | Serozem soil |
| Zencor | Tomatoes | 10 | 100 | Gravelly soil |
| Kotofor | Potatoes | 30 | 130 | Serozem soil |
| Kotofor | Watermelons | 20 | 121 | Serozem soil |

The following uses are not recommended from a hygienic standpoint:

• Zencor application on serozem soil for potato and tomato plantings at a rate of 20 kg/ha.

• Zencor application on gravelly soil for tomato plantings at a rate of 15 kg/ha.

• Kotofor application on serozem soil for potatoes at a rate of 40 kg/ha, or for watermelon plantings at 28 kg/ha.

## Conclusions:

The results of the study on the persistence, migration, and translocation processes of Zencor and Kotofor in the soil-plant system, and the factors influencing the dynamics of these processes, allow us to classify Zencor and Kotofor as belonging to the second group in terms of environmental stability according to hygienic classifications. The lifespan (T95) of Zencor and Kotofor ranges from 171 to 204 days and 102 to 162 days, respectively.

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